Rheological Model for a Heterogeneous Lower Crust with a Quartzo-Feldspathic Mineralogy

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The Landers-Big Bear earthquake sequence of July 1992 in southeastern California caused a rapidly evolving, and widespread, post-seismic crustal deformation signal. The origin of this rapid evolution is, perhaps, tied 10 the ductile deformation of rocks rich in quartzites, or to the fine-graincd rocks typical of intense localized shear zones. The latter rocks arc generally refered to as 'mylonitic'. Collectivel y, however, such rocks constitute only a small portion, by volume, of the lower continental crust and composite media theory predicts that extreme softening by relatively small concentrations (1 - 5 %) of weak inclusion material in a harder matrix occurs only under rather unusual circumstances, such as an oriented fabric of weak inclusions that arc interconnected. In modeling postseismic strain and stress diffusion it is necessary to incorporate viscoelasticit y. Two composite medi a theories arc explored assuming Maxwell viscoelasticity and it is found that flat-lying ellipsoidal inclusions weaken the crust significantly at concentration levels of about 5 %. The ductile rheology of both natural and synthetic quartzites at lower crustal conditions *[e.g., Wang, et. al., 1994, Science* 265, 1204-1206: *Luan and Paterson,* 1992, *JGR* 97, 301-320] has been extensively studied in the laboratory. Composite theory for aligned cl] ipsoidal inclusions at relativel y low concentrat ion enables us 10 demonstrate the consistency of such Laboratory-derived laws with postseismic observations. Here wc discuss the full viscoelastic stiffness moduli and anisotropic behavior of the composite model over both long and short time scales.